

Eric A. Larson
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Fax: 724-643-8069January 6, 2014
L-13-408

10 CFR 50.73

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001**SUBJECT:**Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
LER 2013-003-00

Enclosed is Licensee Event Report (LER) 2013-003-00, "Beaver Valley Unit 1 Turbine Trip and Subsequent Manual Reactor Trip due to 4KV Cable Fault." This event is being reported in accordance with 10 CFR 50.73(a)(2)(iv)(A).

There are no regulatory commitments contained in this submittal. Any actions discussed in this document that represent intended or planned actions are described for the NRC's information, and are not regulatory commitments.

If there are any questions or if additional information is required, please contact Mr. Brian F. Sepelak, Supervisor, Regulatory Compliance at 724-682-4282.

Sincerely,


for Eric A. Larson

Enclosure – LER 2013-003-00

cc: Mr. W. M. Dean, NRC Region I Administrator
Ms. E. E. Carfang, NRC Resident Inspector
Mr. J. A. Whited, NRR Project Manager
INPO Records Center (via INPO Consolidated Event System)
Mr. L. E. Ryan (BRP/DEP)

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NRR

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION (10-2010) <div style="text-align: center;"> LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block) </div>				APPROVED BY OMB NO. 3150-0104 EXPIRES 10/31/2013 Estimated burden per response to comply with this mandatory information collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA/Privacy Section (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov , and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.																																										
1. FACILITY NAME Beaver Valley Power Station Unit Number 1				2. DOCKET NUMBER 05000334		3. PAGE 1 OF 4																																								
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5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED																																					
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9. OPERATING MODE <div style="text-align: center;">Mode 1</div>			11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) <table style="width:100%; border: none;"> <tr> <td><input type="checkbox"/> 20.2201(b)</td> <td><input type="checkbox"/> 20.2203(a)(3)(i)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(C)</td> <td><input type="checkbox"/> 50.73(a)(2)(vii)</td> </tr> <tr> <td><input type="checkbox"/> 20.2201(d)</td> <td><input type="checkbox"/> 20.2203(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(1)</td> <td><input type="checkbox"/> 20.2203(a)(4)</td> <td><input type="checkbox"/> 50.73(a)(2)(ii)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(viii)(B)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(i)</td> <td><input type="checkbox"/> 50.36(c)(1)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(iii)</td> <td><input type="checkbox"/> 50.73(a)(2)(ix)(A)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(ii)</td> <td><input type="checkbox"/> 50.36(c)(1)(ii)(A)</td> <td><input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(x)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iii)</td> <td><input type="checkbox"/> 50.36(c)(2)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(A)</td> <td><input type="checkbox"/> 73.71(a)(4)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(iv)</td> <td><input type="checkbox"/> 50.46(a)(3)(ii)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(B)</td> <td><input type="checkbox"/> 73.71(a)(5)</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(v)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(A)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(C)</td> <td><input type="checkbox"/> OTHER</td> </tr> <tr> <td><input type="checkbox"/> 20.2203(a)(2)(vi)</td> <td><input type="checkbox"/> 50.73(a)(2)(i)(B)</td> <td><input type="checkbox"/> 50.73(a)(2)(v)(D)</td> <td>Specify in Abstract below or in NRC Form 366A</td> </tr> </table>								<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A
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ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)																																														
<p>On November 5, 2013 at 1747 hours, Beaver Valley Power Station (BVPS) Unit 1 was operating at 47 percent power after the 1R22 Refueling Outage. The Unit 1 Control Room received multiple unexpected alarms. The Turbine/Generator tripped due to Unit Station Service Transformer (USST) "BV-TR-1C" differential protection relay actuation. This transformer was energized but not in service at the time. The reactor operator manually tripped the reactor due to multiple unexpected alarms. An automatic reactor trip signal was not generated due to the fact that the reactor was operating at a power level less than the turbine trip – reactor trip setpoint of 49 percent power. The Steam Driven Auxiliary Feedwater (AFW) pump automatically started due to low level in the "C" Steam Generator. The "B" Motor Driven AFW pump was manually started to assist in maintaining steam generator levels. An Unusual Event was declared at 1828 hours due to reports from the fire brigade that an explosion had occurred in a cable tray in the Unit 1 turbine building mezzanine. The cause of this event was determined to be a fault in the "B" 4KV bus supply cables from BV-TR-1C that resulted in an arc flash and subsequent fire. Corrective actions include planned replacement of the faulted supply cables and inspections of the remaining Unit 1 and Unit 2 4KV bus supply cables for signs of degradation and aging.</p> <p>This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as a condition that resulted in the valid manual and automatic actuation of systems listed in (a)(2)(iv)(B) – (1) manual Reactor trip, (6) manual and automatic Auxiliary Feedwater pump start. A 10 CFR 50.72 notification was made at 1927 hours on November 5, 2013 to report entry into an Unusual Event, RPS Actuation and a Specified System, Auxiliary Feedwater actuation (EN 49505).</p>																																														

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CONTINUATION SHEET

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NARRATIVE

Energy Industry Identification System (EIIIS) codes are identified in the text as [XX].

CONDITIONS PRIOR TO OCCURRENCE

Unit 1: Mode 1, 47%

There were no systems, structures, or components (SSCs) that were inoperable at the start of the event that contributed to the event.

DESCRIPTION OF EVENT

On November 5, 2013 at 1747 hours, Beaver Valley Power Station (BVPS) Unit 1 was operating at 47 percent power after the 1R22 Refueling Outage. The Unit 1 Control Room received multiple unexpected alarms, including Turbine trip [ALM], Main Transformer Differential Protection Generator Trip [ALM], Unit Station Service Transformer BV-TR-1C Fire [FRA], and Turbine Room Fire [FRA]. The Generator [GEN] tripped on "BV-TR-1C" transformer [XFMR] differential protection. The reactor operator manually tripped the reactor [RCT] due to the receipt of multiple unexpected alarms. An automatic reactor trip signal was not generated nor expected to be generated because the reactor was operating at a power level less than the turbine trip – reactor trip setpoint of 49 percent power. The Steam Driven Auxiliary Feedwater [BA] (AFW) pump [P] automatically started due to low level in the "C" Steam Generator [SG]. The "B" Motor Driven AFW [BA] pump [P] was manually started to assist in maintaining steam generator levels. At 1819 hours the Steam Driven AFW pump was secured to support Reactor Coolant System [AB] (RCS) temperature control. At 1828 hours an Unusual Event was declared due to reports from the fire brigade that an explosion had occurred in a cable tray [TY] in the Unit 1 turbine building mezzanine. A cable failure had occurred in the Unit 1 turbine building mezzanine level where the 4KV bus supply cables [CBL5] pass through the wall into the service building to the electrical switchgear room. The failure resulted in an arc flash (explosion) and fire in the "B" 4KV bus supply cabling causing catastrophic failure of the cables and significant damage to adjacent bus cabling. The fire protection deluge system [KP] activated and suppressed the fire. Unit Station Service Transformers [XFMR] (USST) "BV-TR-1C" and "BV-TR-1D" were rendered out of service. The Unit was brought to stable Mode 3 conditions. The Unusual Event was terminated at 1959 hours.

The electrical fault on the 4KV bus supply cables from the "BV-TR-1C" USST to the "B" normal 4KV bus resulted in an automatic Main Unit Generator trip. At the time of the event, the USSTs and the associated bus supply cables were energized but were not in service (not loaded). The USSTs were not connected to any of the four normal 4KV electrical busses. The normal 4KV electrical busses were being powered from the offsite supply System Station Service Transformers [XFMR] (SSST). No electrical fault occurred on the USST "BV-TR-1D", although its 4KV bus supply cables sustained damage due to their proximity to the fault. No transient was seen on the 4KV busses or the SSSTs "BV-TR-1A" and "BV-TR-1B". Normal and emergency power supplies were maintained during this event.

CAUSE OF EVENT

An investigation has determined that the "B" 4KV bus supply cables faulted causing an arc flash and fire. The cables experienced a diminished service life due to long term ohmic heating within the cable tray enclosure. The heating occurred because these cables are normally in service and loaded. The cable monitoring program was not effective in identifying the degradation.

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BVPS 4KV SYSTEM DESCRIPTION

The BVPS 4KV Station Service System consists of four normal 4KV busses (A, B, C and D), two emergency busses (AE and DF), and four supply transformers. Each normal bus can be supplied from either the offsite power supply (SSSTs BV-TR-1A and 1B) or the onsite power supply (USSTs BV-TR-1C and 1D). Each transformer can supply two 4KV busses. Either BV-TR-1A or 1C can supply the "A" and "B" 4KV busses. Either BV-TR-1B or 1D can supply the "C" and "D" 4KV busses.

When the No. 1 Main Unit Generator is shut down, the 4KV busses are normally powered from the SSSTs 1A and 1B. When the No. 1 Main Unit Generator is operating and at full power, the 4KV busses are typically powered from USSTs BV-TR-1C and BV-TR-1D.

ANALYSIS OF EVENT

The Unit 1 Control Room received multiple unexpected alarms. The Turbine/Generator tripped on "BV-TR-1C" transformer differential protection. The reactor operator manually tripped the reactor due to multiple unexpected alarms. An automatic reactor trip signal was not generated since the reactor was operating at 47 percent power which is less than the turbine trip – reactor trip setpoint of 49 percent power. The Steam Driven AFW pump automatically started due to low level in the "C" Steam Generator. The "B" Motor Driven AFW pump was manually started to help maintain steam generator levels. All systems responded as designed.

An electrical fault on the Unit 1 4KV bus supply cables from the "BV-TR-1C" USST to the "B" normal 4KV bus resulted in the trip of the Main Unit Generator. At the time of the trip the SSSTs (BV-TR-1A and BV-TR-1B) were in service to provide power to the normal 4KV busses. The PRA risk associated with this event is modeled as a Turbine Trip and subsequent Reactor Trip.

The plant risk associated with the BVPS Unit 1 Turbine Trip and subsequent Reactor Trip due to the 4KV bus supply cable fault, explosion, and fire in the turbine building mezzanine is considered to be very low. This is based on the conditional core damage probability and conditional large early release probability for this event when considering the actual plant conditions that were present at the time of the event.

Based on historical usage, visual examinations and thermography, the condition of the cables associated with the Unit 1 offsite power supply from the SSSTs indicate they are not degraded, and are fully capable of powering the station loads of the 4KV busses during normal plant operation until the onsite power supply cables are replaced. The Unit 2 onsite and offsite power supply cables are not the same type of cables that are installed at Unit 1. Unit 2 cables are manufactured by the Kerite company, whereas the Unit 1 cables were manufactured by Okonite. Unit 2 normal 4KV bus supply cables were visually examined at the normal 4KV switchgear cubicles and no signs of degradation were observed.

This event is being reported under 10 CFR 50.73(a)(2)(iv)(A) as a condition that resulted in the valid manual and automatic actuation of systems listed in (a)(2)(iv)(B) – (1) manual Reactor trip, (6) manual and automatic Auxiliary Feedwater pump start. A 10 CFR 50.72 notification was made at 1927 hours on November 5, 2013 to report entry into an Unusual Event, RPS Actuation and a Specified System, Auxiliary Feedwater, actuation (EN # 49505).

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CORRECTIVE ACTIONS

1. A visual examination of the accessible portions of the Unit 1 offsite 4KV bus supply cables was performed. These cables did not exhibit the degradation noted on the failed onsite supply cables.
2. Thermography inspections of the Unit 1 offsite supply cables were performed. Temperatures were consistent along their entire length. No hot spots were identified on any of the cables surveyed.
3. The Unit 1 onsite 4KV bus supply cables will be replaced under an Engineering Change Package (ECP).
4. The Unit 1 offsite, Unit 2 offsite and Unit 2 onsite 4KV bus supply cables will have additional inspections performed for signs of cable degradation or aging.
5. The results of laboratory inspection and testing of the failed cables will be reviewed and documented in the Corrective Action Program.
6. The Cable Management Program will be revised based on lessons learned from this event and mitigating strategies will be implemented in the interim.

Completion of the above and other corrective actions are being tracked through the BVPS Corrective Action Program.

PREVIOUS SIMILAR EVENTS

A review identified the following historical BVPS Unit 1 event involving an electrical fault and subsequent fire.

BVPS LER 1994-005-000 "Main Transformer Bushing Failure Results in Electrical Grid Disturbance and Dual Unit Reactor Trip"

CR 2013-17888